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Clouds Influence on Atmospheric Ozone from GOME-2 Satellite Measurements

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Abstract : This study is mainly focused on the determination and analysis of the photolysis rate of atmospheric, specifically tropospheric, ozone as function of cloud properties through-out the year 2007. The observational basis for ozone concentrations and cloud properties are the measurement data set of the Global Ozone Monitoring Experiment-2 (GOME-2) sensor on board the polar orbiting Metop-A satellite. Two different spectral ranges are used; ozone total column are calculated from the wavelength window 325 – 335 nm, while cloud properties, such as cloud top height (CTH) and cloud optical thick-ness (COT) are derived from the absorption band of molecular oxygen centered at 761 nm. Cloud fraction (CF) is derived from measurements in the ultraviolet, visible and near-infrared range of GOME-2. First, ozone concentrations above clouds are derived from ozone total columns, subtracting the contribution of stratospheric ozone and filtering those satellite measurements which have thin and low clouds. Then, the values of ozone photolysis derived from observations are compared with theoretical modeled results, in the latitudinal belt 5˚N-5˚S and 20˚N - 20˚S, as function of CF and COT. In general, good agreement is found between the data and the model, proving both the quality of the space-borne ozone and cloud properties as well as the modeling theory of ozone photolysis rate. The found discrepancies can, however, amount to approximately 15%. Latitudinal seasonal changes of photolysis rate of ozone are found to be negatively correlated to changes in upper-tropospheric ozone concentrations only in the autumn and summer months within the northern and southern tropical belts, respectively. This fact points to the entangled roles of temperature and nitrogen oxides in the ozone production, which are superimposed on its sole photolysis induced by thick and high clouds in the tropics.

Keywords : cloud properties, photolysis rate, stratospheric ozone, tropospheric ozone
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